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Role and Extent of Agricultural Advisory Support for Vegetable Growers amidst the COVID-19 Crisis

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Abstract

The COVID-19 pandemic has created far-reaching disruptions across sectors globally, with agriculture facing some of the most immediate and severe consequences. It exposed the vulnerabilities in agricultural food production and value chains affecting the livelihood security of vegetable growers. The present research evaluates the role and extent of agricultural advisory support to the vegetable growers during the COVID-19 pandemic. An ex-post facto research design was followed along with a multistage sampling technique for the selection of 240 vegetable growers across 8 villages in 4 blocks from 2 districts of Odisha. The analysis showed that the majority of the respondents contact input dealers and distributors as the primary source of information, with a pooled mean score of 2.81. Meanwhile, they consider mobile phones as the most accessible ICT tool with a pooled mean score of 2.78, and about 84.00% of the respondents use them regularly for receiving advisory support during the COVID-19 pandemic. It is observed that the majority (79.00%) of the respondents received advice on relief packages, govt. schemes, policies, and programmes as major advisory support on the production activities of vegetables. Whereas, most (81.00%) of the respondents received information on price change and trends in the market as primary advice on the marketing activities of vegetables during the COVID-19 pandemic. The findings reveal that input dealers and mobile phones were the key constituents of agricultural advisory, while farmers use mobile phones regularly for receiving the advisory during the pandemic. The research highlights the importance of agricultural advisory support at the time of crisis and seeks to identify systemic gaps, opportunities, and offer recommendations for more advanced, resilient, and accessible during crises for the revitalization of the agricultural sector.

Keywords

COVID-19; Pandemic; Agricultural advisory; Vegetable growers

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Introduction

The COVID-19 pandemic is one of the most unprecedented global health crises in recent history. It has profoundly created far-reaching disruptions to societies and economies around the world. The recent outbreak of the novel SARS-CoV-2 virus, also called coronavirus 2019 (COVID-19), has evolved into one of the most serious pandemic situations in the past hundred years (Dhama *et al.,* 2020a, 2020b; Sohrabi *et al.,* 2020). It has risked both the lives and livelihoods of people at a global scale, and its fullest impacts are yet to be observed (Morton, 2020). In order to control the spread of the virus, various health guidelines were put in place in almost all countries, such as maintaining social distancing, regional and national lockdowns, travel restrictions, and placing people in quarantine (Lu *et al.,* 2021; Memon, Qureshi and Memon, 2021). The entire global population has been experiencing lockdown situations aimed at slowing down the spread of the disease, causing disruption to economic activities and abrupt changes in policies to mitigate the pandemic's health impacts (Ayittey *et al.,* 2020; Bhagavathula *et al.,* 2020; Chatterjee *et al.,* 2020; Kumar *et al*., 2020c; Singh *et al*., 2020a). Lockdowns imposed to mitigate COVID-19 had a wide-ranging impact on society globally (Sarker *et al.,* 2021). The pandemic has had direct and indirect impacts at the individual, household, community, district, regional, national, and international levels (Talukder *et al.,* 2021). Almost all the socio-economic sectors have been adversely affected by the pandemic along with the agriculture sector being no exception (Gray, 2020; Rozaki, 2020). Agriculture is a vital part of India's economy, which plays a crucial role in ensuring food security and supporting rural livelihoods. It is the main source of income for a large proportion of the population in developing countries such as India (Kumar *et al.,* 2021). Where the principal activities are usually related to the farm level systems and agricultural production (Singh *et al.,* 2020b). Developing countries, however, are more vulnerable to the pandemic's detrimental effects than developed countries owing to their scarce resources, experience, and technologies (Nemes *et al.,* 2021). The agricultural sector in India contributes substantially to the gross domestic product and employs over half of the country's rural population (Baffoe-Bonnie and Kostandini, 2019). Vegetable cultivation is an important part of Indian agriculture, which is intrinsically linked to rural income and livelihoods. India is the second-largest producer of vegetables in the world, after China. The COVID-19 pandemic and its cascading effects have adversely impacted the vegetable growers by disrupting their production activities, supply chains, and market access. Most of the vegetable growers are small and marginal farmers engaged in vegetable cultivation, who have faced unique challenges largely due to the perishable nature of their produce, reliance on local markets, and labour-intensive nature of their farming practices. The farming community, dominated by small and marginal landholders, is more vulnerable because of their weak coping capacity (Hossain and Atibudhi, 2024). The farmers who produce perishable products such as vegetables were severely impacted by the pandemic because of the loss of conventional markets and having little option to sell their produce but to destroy the unsold produce (Adhikari *et al.,* 2021; Alam and Khatun, 2021). As a consequence, farmers' incomes and purchasing power have been reduced, leaving farm households financially vulnerable (Tripathi *et al.,* 2021). The COVID-19 health policies, such as nationwide lockdowns and state-level restrictions, have led to market closures, limited transportation, labour shortages, and scarcity of inputs, increasing their costs and

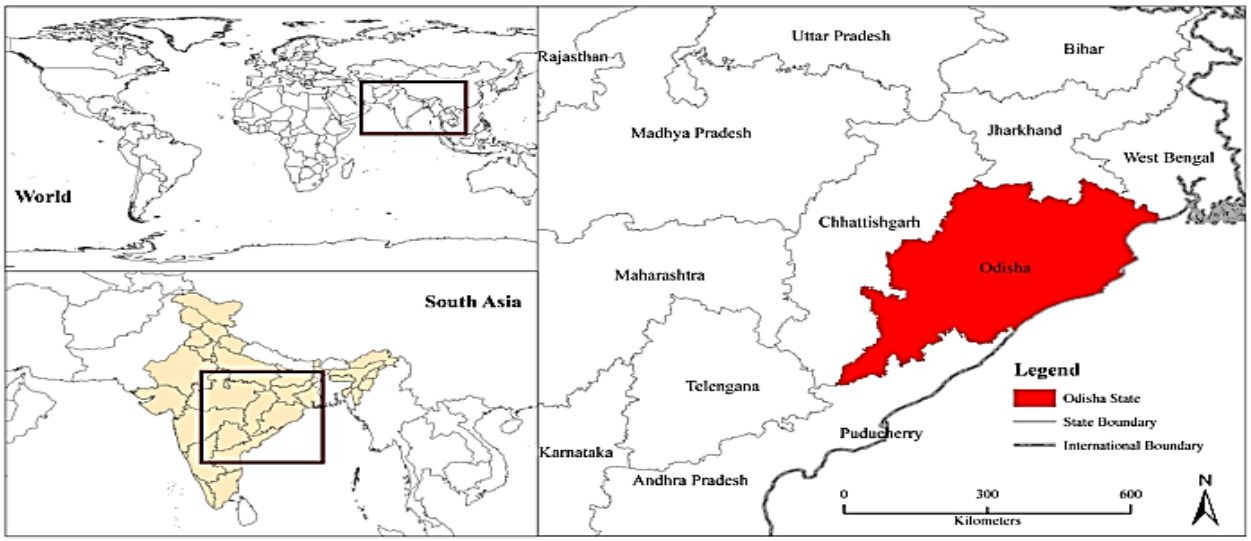
availability, leading to disruptions throughout the supply chains (Ceballos, Kannan and Kramer, 2020). It has threatened the farming community due to the periodic and prolonged lockdowns, transport restrictions, and lack of buyers in the market (Morton, 2020; Mishra, Bruno and Zilberman, 2020), severely affecting both the supply and demand for agro-foods (Dev, 2020). On top of these already existing problems, the pandemic has caused widespread disruptions across a wide range of agri-food actors, posing a new challenge (Paparella *et al.,* 2022). Due to extensive mitigation strategies, rather than health impacts, that have had the greatest negative impact on the domestic and international food supply systems (Talukder *et al.,* 2021; Adhikari *et al.,* 2021; Kumar *et al*., 2021; Weersink *et al.,* 2021). The timing, duration, and stringency of the restriction measures, as well as the appropriate policies to mitigate their adverse impacts, were identified as the main factors contributing to food system disruptions (Picchioni, Goulao and Roberfroid, 2021). It has led to disruptions in food production and the whole food supply chain with direct effects on both producers and consumers (Stephens *et al.,* 2020; Torero, 2020; United Nations, 2020). Amid the phase of unprecedented crisis, agricultural advisory support has played a pivotal role in helping farmers adapt to rapidly changing conditions. Agricultural advisory support comprises the entire set of organizations that support farmers engaged in agricultural production and facilitate their efforts to solve problems by linking to the markets and other players in the agricultural value chain and obtaining information, skills, and technologies for improving their livelihoods. It plays a crucial role in guiding farmers through uncertainty by providing timely and relevant information. The outbreak of the coronavirus pandemic has prevented the provision of advisory services for farmers due to the restrictions placed on movement and personal contact (Forsido *et al*., 2020). Its negative effect had created temporary restrictions on physical movement, which ultimately made the communication delay among many functionaries involved in vegetable cultivation. Farmers were unable to get the latest information on agricultural and food systems in general (IFAD *et al.,* 2021). The crisis had not only limited physical mobility and market interactions but also strained the capacities of advisory support to reach farming communities. Among those most affected are the vegetable growers, who rely heavily on timely, accurate, and location-specific advisory support in order to make critical decisions on cultivation practices of vegetables. These disruptions highlighted the need for timely, accessible, and effective agricultural advisory support to help farmers navigate the uncertain. Evaluating the role and extent of agricultural advisory support for vegetable growers amidst the COVID-19 crisis is critically important to analyze the systemic gaps and strengths within the agricultural advisory framework. It aims to identify opportunities for strengthening the agricultural advisory ecosystem and offers recommendations for improving the resilience and responsiveness at times of future crisis and beyond.

Materials and Methods

Study Area

The present study was conducted in the state of Odisha, located on the eastern coast of India. It is the eighth-largest state in terms of area, characterized by diverse agro-climatic conditions**.** The tropical, warm, and humid climate of the region makes it suitable for a wide range of agricultural activities. Odisha is predominantly an agrarian state**,** where

agriculture plays a primary role in the state's economy and livelihood. In terms of vegetable production, Odisha ranks seventh among the major vegetable-producing states in India with a 4.7% share of the country's total production. The major vegetables grown



include sweet potato, brinjal (eggplant), cabbage, cauliflower, and okra**.**

Figure 1: Geographic location of Odisha in India

Selection of the Sample Area

The state of Odisha was purposively selected based on its significant contribution to vegetable production in India. It comprises 10 agro-climatic zones, out of which, for this study, two agro-climatic zones, the North Eastern Coastal Plain and East and South Eastern Coastal Plain, were selected. These zones are known for their favourable agro-ecological conditions that support intensive vegetable cultivation. Within these zones, Balasore district (North Eastern Coastal Plain) and Cuttack district (East and South Eastern Coastal Plain) were selected purposively based on the maximum total area of the region under vegetable farming. Following this, two blocks were randomly selected from each of the two districts. From each block, two-gram panchayats were randomly selected, and within each gram panchayat, two villages were chosen using simple random sampling. An ex-post facto research design was adopted to study the variables, whereas a total of 240 vegetable growers were selected by using proportionate random sampling, as illustrated in table 1. For the study, a multistage sampling technique was used across 8 villages in 4 blocks from 2 districts of Odisha.

Data Collection and Analysis

Data for the study were collected from both primary and secondary sources to gain a comprehensive understanding of the views of the vegetable growers. Primary data was obtained through face-to-face interviews with the respondents, using a structured interview schedule which was carefully developed following the objectives of the study. The detailed interview schedule used for data collection is provided in Annexure-I. The secondary data was collected with the help of field extension functionaries, Assistant

horticultural officers (AHO), KVK scientists, along with various block-level and district-level officials, respectively. The schedule included both closed ended and open-ended questions, covering various aspects of the agricultural advisory support such as sources of information, access to ICT tools which include farm literatures (Magazine/Folder/Leaflets etc.), you tube, television (TV), mobile phone, WhatsApp, radio and interactive voice response (IVR), extent of utilization of ICT tools and information on production and marketing activities of vegetables. It was pre-tested in a non-sample area to ensure its reliability and validity, and necessary modifications were made based on the feedback received. In addition to individual interviews, focused group discussions (FGDs) were conducted to encourage interaction among growers and gather their collective perspectives. To ensure accuracy and minimize bias, data were collected with the support of local facilitators, including informed consent from all participants and confidentiality of responses. Once collected, the data were coded, tabulated, and analyzed using descriptive statistics, allowing a comprehensive analysis for evaluating the role and extent of agricultural advisory support for vegetable growers amidst the COVID-19 crisis.

Table 1: Levels of selected sampling areas and their respective sampling methods employed

Step	*Items*	*Level*	*Procedure*
1.	State	Odisha	Purposive sampling
2.	Agro-ecological zones	North eastern coastal plain and East and South Eastern coastal plain	Purposive sampling
3.	District	Balasore and Cuttack	Purposive sampling
4.	Block	Baliapal and Basta (Balasore), Cuttack sadar and Niali (Cuttack)	Random sampling
5.	Gram Panchayat	Baniadiha and Bodas (Baliapal) (Balasore) Kulida and Santoshpur (Basta) (Balasore) Khandeita and Aman (Cuttack sadar) (Cuttack) Jallarpur and Nivarana (Niali) (Cuttack)	Random sampling
6.	Village	Baniadiha-Bhanreswar and Bodas-Tahalia Kulida-Demuria and Santoshpu-Teghari khandeita-Sankhatras and Aman-Sabalpur Jallarpur-Lunigan and Nivarana-Rokida	Random sampling
7.	Respondents	Respondents from each village	Propionate Random sampling

Results

Agricultural advisory support plays an indispensable role at the frontline in response to the pandemic. It plays a major role in knowledge dissemination and advising the farming community to effectively deal with the challenges of production, post-production, and marketing in times of uncertainty. The findings of the study help to analyse the role and extent of agricultural advisory support in order to safeguard the interests of the farming community. It addresses the need and relevance of the vegetable growers during the COVID-19 pandemic.

Sources of Information

Sources of information act as an essential component for the efficient dissemination of agricultural advisory support. From the table-2, It is observed that majority of the respondents contact "Input dealers and distributors" as the primary source of information to receive advisory support during the pandemic with a pooled mean score of 2.81 and ranked-I, followed by "Progressive farmers/other farmers" with a pooled mean score of 2.77 and ranked-II, "Extension functionaries" with a pooled mean score of 2.65 and ranked-III, "Kisan Call Center" with a pooled mean score of 2.58 and ranked-IV, "Neighbors/Friends/relatives" with a pooled mean score of 2.46 and ranked-V, "Farmers group/NGOs/FPOs" with a pooled mean score of 2.31 and ranked-VI, "Agricultural officers (AAOs, AHOs etc.)" with a pooled mean score of 1.94 and ranked-VII and Lastly, the respondents contact "University/KVK scientists" to receive advisory support during the pandemic with a pooled mean score of 1.89 and ranked-VIII.

Table 2: Distribution of the respondents based on sources of information

Sl. No.	*Sources of information*	*Mean score*		*Diff (%)*	*Pooled mean score (n=240)*	*Rank*
		Balasore District (n=120)	*Cuttack District (n=120)*			
1.	Progressive farmers/other farmers	2.73	2.81	2.84	2.77	II
2.	Neighbors/Friends/relatives	2.48	2.44	1.61	2.46	V
3.	Agricultural officers (AAOs, AHOs, etc.)	1.92	1.96	2.04	1.94	VII
4.	Input dealers and distributors	2.82	2.79	1.06	2.81	I
5.	University/KVK scientists	1.87	1.91	2.09	1.89	VIII
6.	Extension functionaries	2.64	2.66	0.75	2.65	III
7.	Farmers group/NGOs/FPOs	2.27	2.35	3.40	2.31	VI
8.	Kisan Call Center	2.60	2.56	1.53	2.58	IV
Maximum obtainable score-3						

Accessibility to ICT Tools

Accessibility to ICT tools is the degree to which various ICT tools are used to access the agricultural advisory support by the respondents. From the table-3, It is inferred that majority of the respondents use "mobile phone" as an important and most accessible ICT tool for receiving the advisory support during the pandemic with a pooled mean score of 2.78 and ranked-I, followed by the use of "television (T.V)" with a pooled mean score of 2.71 and ranked-II, "WhatsApp" with a pooled mean score of 2.63 and ranked-III, "you tube" with a pooled mean score of 2.57 and ranked-IV, "Interactive Voice Responses (IVR)" with a pooled mean score of 2.40 and ranked-V, "Radio" with a pooled mean score of 1.98 and ranked-VI and Lastly, the respondents use "Farm

literatures (Magazine/Folder/Leaflets etc.)" as an ICT tool to receive the advisory support during the pandemic with a pooled mean score of 1.85 and ranked-VII.

Table 3: Distribution of the respondents based on accessibility to ICT tools

Sl. No.	*ICT Tools*	*Mean score*		*Diff (%)*	*Pooled mean score (n=240)*	*Rank*
		Balasore District (n=120)	*Cuttack District (n=120)*			
1.	Farm literatures (Magazine/Folder/Leaflets, etc.)	1.88	1.82	3.19	1.85	VII
2.	YouTube	2.54	2.60	2.30	2.57	IV
3.	Television (TV)	2.73	2.68	1.83	2.71	II
4.	Mobile phone	2.76	2.80	1.42	2.78	I
5.	WhatsApp	2.58	2.67	3.37	2.63	III
6.	Radio	1.95	2.01	2.98	1.98	VI
7.	Interactive Voice Response (IVR)	2.42	2.38	1.65	2.40	V
Maximum obtainable score-3						

Extent of Utilization of ICT Tools

The extent of utilization of ICT tools refers to the frequency of use of various ICT tools for obtaining agricultural advisory support. From the table-4, It is found that majority (84.00%) of the respondents use "mobile phone" on 'Regular' basis, while (12.00%) of the respondents use on 'occasional' basis whereas only (4.00%) of the respondents use on 'Rare' basis to receive advisory support during the pandemic followed by (75.00%) of the respondents use "television (T.V)" on 'Regular' basis, while (16.00%) of the respondents use on 'occasional' basis and (9.00%) of the respondents use on 'Rare' basis, (72.00%) of the respondents use "WhatsApp" as an ICT tool on 'Regular' basis, while (20.00%) of the respondents use on 'occasional' basis and (9.00%) of the respondents use on 'Rare' basis. (13.00%) of the respondents use "you tube" as an ICT tool on 'Regular' basis, while (77.00%) of the respondents use on 'occasional' basis and (10.00%) of the respondents use on 'Rare' basis, (18.00%) of the respondents use "Interactive Voice Responses (IVR)" as an ICT tool on 'Regular' basis, while (67.00%) of the respondents use on 'occasional' basis and (15.00%) of the respondents use on 'Rare' basis, (11.00%) of the respondents use "Radio" as an ICT tool on 'Regular' basis, while (27.00%) of the respondents use on 'occasional' basis whereas a majority (62.00%) of the respondents use on 'Rare' basis, lastly (14.00%) of the respondents use "Farm literatures (Magazine/Folder/Leaflets etc.)" as an ICT tool on 'Regular' basis, while (21.00%) of the respondents use on 'occasional' basis and majority (65.00%) of the respondents use on 'Rare' basis to receive the advisory support during the pandemic.

Advisory on Vegetable Production

The information on the production activities of vegetables is crucial for efficient vegetable cultivation practices. Table 5 indicates the rank order of the advisory support received on the production activities of vegetables by the respondents during the

COVID-19 pandemic. It is observed that majority (79.00%) of the respondents received advisory on "Relief packages, govt. schemes, policies and programmes" as major advisory and ranked I, followed by (76.00%) of the respondents received advisory on "Credit facilities and crop insurance" with rank II, "Price and availability of quality agricultural inputs" (70.00%) with rank III, "rainfall and weather related aspects" (67.00%) with rank IV, "Disease, pest and fertilizer management" with rank V (64.00%), "Seed treatment and selection of planting materials" (58.00%) with rank VI, "Field preparation activities and soil testing" (52.00%) with rank VII, "Nursery management" (45.00%) with rank VIII, "Sowing and transplanting of vegetable crops" (43.00%) with rank IX and lastly, "Harvesting and post-harvest management" (36.00%) of least concern with rank X respectively.

Table 4: Distribution of the respondents based on the extent of utilization of ICT tools

Sl. No.	*ICT Tools*	*Frequency of use*					
		Regular		*Occasional*		*Rare*	
		f	*%*	*f*	*%*	*f*	*%*
1.	Farm literatures (Magazine/ Folder/ Leaflets, etc.)	34	14.00	50	21.00	156	65.00
2.	YouTube	31	13.00	185	77.00	24	10.00
3.	Television (TV)	180	75.00	39	16.00	21	9.00
4.	Mobile phone	202	84.00	28	12.00	10	4.00
5.	WhatsApp	173	72.00	48	20.00	19	8.00
6.	Radio	26	11.00	65	27.00	149	62.00
7.	Interactive Voice Response (IVR)	44	18.00	160	67.00	36	15.00

Table 5: Distribution of the respondents based on advisory support received on the production activities of vegetables

Sl. No.	*Information category*	*f*	*%*	*Rank order*
1.	Rainfall and weather-related aspects	160	67.00	IV
2.	Harvesting and post-harvest management	87	36.00	X
3.	Disease, pest, and fertilizer management	153	64.00	V
4.	Field preparation activities and soil testing	125	52.00	VII
5.	Price and availability of quality agricultural inputs	167	70.00	III
6.	Seed treatment and selection of planting materials	140	58.00	VI
7.	Credit facilities and crop insurance	182	76.00	II
8.	Sowing and transplanting of vegetable crops	103	43.00	IX
9.	Relief packages, govt. schemes, policies, and programmes	190	79.00	I
10.	Nursery management	108	45.00	VIII

Advisory on Marketing of Vegetables

The information on the marketing activities of vegetables is essential for the effective delivery of the farm produce. From Table 6, it is noticed that the rank order of the advisory support received on the marketing activities of vegetables by the respondents during the COVID-19 pandemic. It is evident that majority (81.00%) of the respondents received advisory on "Information on price change and trends in the market" as major advisory and ranked I, followed by (78.00%) of the respondents received advisory on "Market demand and supply for agricultural produce" with rank II, "Real time market news" (73.00%) with rank III, "Market intelligence" (66.00%) with rank IV, "Transportation and logistics facilities" with rank V (59.00%), "Post-harvest management" (54.00%) with rank VI, and "Agricultural entrepreneurship" (47.00%) of least concern with rank VII, respectively.

Table 6: Distribution of the respondents based on advisory support received on the marketing activities of vegetables

Sl. no.	*Information category*	*f*	*%*	*Rank order*
1.	Market demand and supply for agricultural produce	187	78.00	II
2.	Transportation and logistics facilities	141	59.00	V
3.	Market intelligence	159	66.00	IV
4.	Real-time market news	175	73.00	III
5.	Price change and trends in the market	194	81.00	I
6.	Agricultural entrepreneurship	113	47.00	VII
7.	Post-harvest management	130	54.00	VI

Discussion

Sources of Information

The data reveals the significant insights of the respondents based on sources of information for agricultural advisory support during the COVID-19 pandemic. From figure 2, it is evident that the majority of the respondents predominantly relied on input dealers, distributors, and progressive or fellow farmers for receiving advisory support, which indicates a strong preference for familiar sources. These sources are often more approachable and available, making them vital during a crisis. Extension functionaries and Kisan Call Center were moderately utilized, indicating some effectiveness, trust, but a need for better awareness and infrastructure development in order to scale their impact during emergencies. Information sources like neighbours, friends, and relatives, along with farmer's group/NGOs/FPOs, still play a substantial role, which highlights the importance of community-based knowledge sharing, especially when institutional support is limited. Whereas, formal sources of information, such as Agricultural officers (AAOs, AHOs, etc.) and University/KVK scientists, were ranked lowest, which shows limited engagement of the respondents with technical and research-based advisory systems. Therefore, this indicates a need for policymakers to improve the visibility, accessibility, and responsiveness of formal advisory systems. To bridge these gaps,

institutions need to build trust within institutional channels and collaborate more closely with the local influencers, improve digital extension services, and invest in capacity-building at the grassroots levels. Strengthening public-private partnerships and investing in digital extension tools could enhance the resilience and effectiveness of agricultural advisory services in the future, especially in times of crisis.

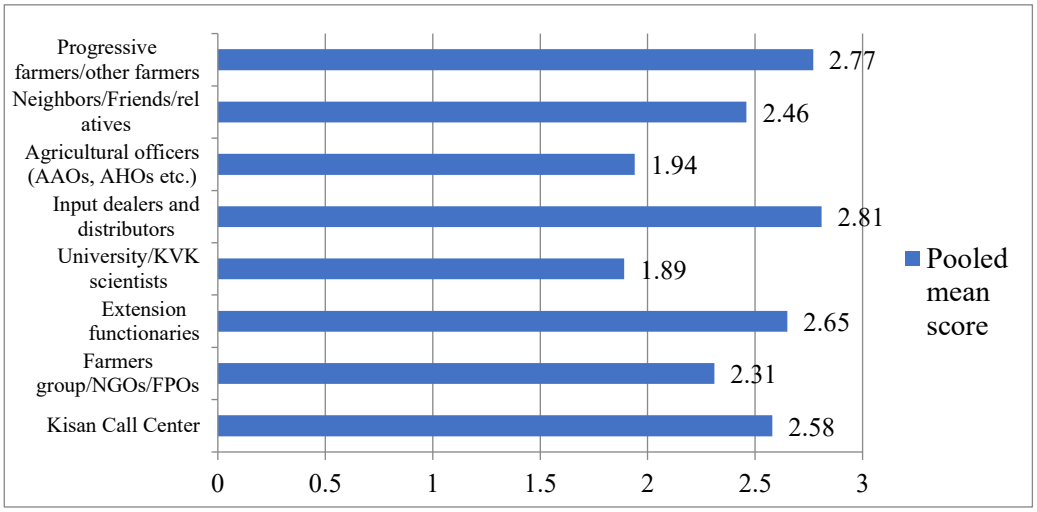


Figure 2: Distribution of the respondents based on sources of information

Access to ICT Tools

The data highlights the accessibility to ICT tools by the respondents to receive advisory support during the pandemic. From figure 3, it is found that the majority of the respondents use a mobile phone as the most accessible and reliable medium for receiving the advisory support. It is a versatile ICT tool that supports both voice and internet-based advisory services, making them a vital tool for agricultural communication during crises. Television (TV) remains a trusted, familiar, and widely popular medium, especially among the older and digitally illiterate farmers. It plays a vital role in disseminating agricultural information, which offers easily understandable and demonstrative content helpful for farmers with varying literacy levels. Broadcast media continues to play a vital role in disseminating agricultural information, especially in areas with limited internet access, serving as a reliable advisory medium. The popularity of WhatsApp and YouTube indicates that social media platforms are emerging as key platforms for advisory services. These ICT tools are easily accessible, which allows mainstreaming for group discussions and rapid information dissemination among the farmers during the period of uncertainty. Interactive Voice Response (IVR) offers a voice-activated support system that enables farmers to access advice using simple voice commands. This technology is especially beneficial for farmers with limited literacy and digital skills. It is an inclusive tool that plays a valuable role in providing advisory support during the pandemic. Whereas, Radio and Farm literature (Magazine/Folder/Leaflets, etc.) were the least accessible ICT tools due to their non-interactive nature, low engagement, and slower information dissemination, combined with the declining popularity as compared to their digital counterparts. These ICT tools have become less relevant, particularly in the rapidly changing and urgent information landscape during emergencies such as a

pandemic. Thus, a clear transition has been observed towards the utilization of mobile-based, digital, and interactive ICT tools for agricultural advisory support. The shift is driven by the need for real-time, accessible, and interactive information in order to enhance communication with the farmers. Further strategies should focus on establishing digital infrastructure and promoting digital literacy among the farmers. The development of farmers' preferred ICT tools and addressing digital divides can help agricultural advisory support to become more responsive, inclusive, and effective, especially in the period of uncertainty.

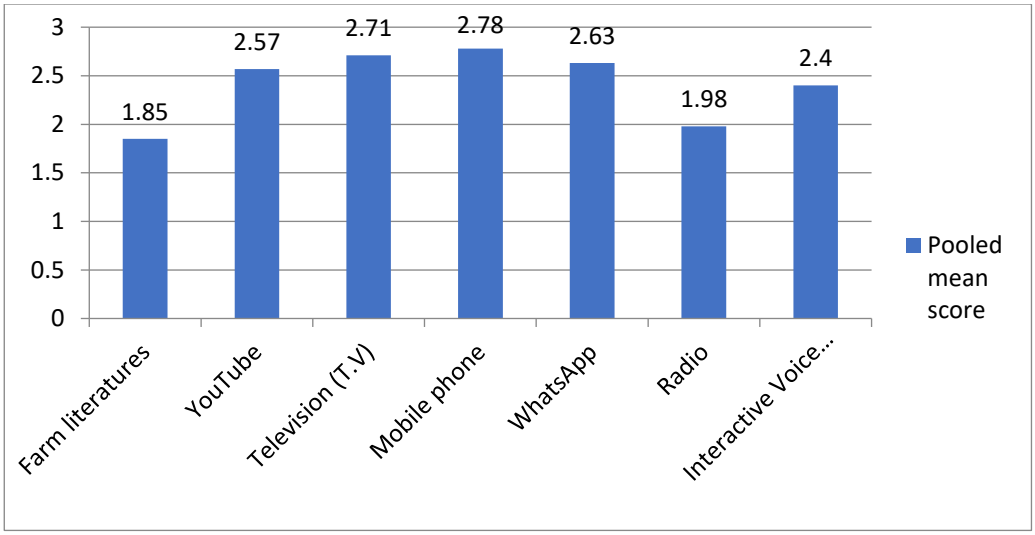


Figure 3: Distribution of the respondents based on accessibility to ICT tools

Extent of Utilization of ICT Tools

The data provides valuable aspects of the respondents on the basis of the extent of utilization of ICT tools to receive advisory support during the COVID-19 crisis. From figure 4, it is concluded that most of the respondents use mobile phones regularly, which is an important and widely used ICT tool, as they offer an efficient and direct channel for delivering advisory support during crises. Television (TV) retains high credibility, which is used regularly for advisory support, especially for broadcasting widespread messages, indicating its strong reach, especially in rural areas. The use of WhatsApp on a regular basis indicates strong engagement of the respondents with social media messaging platforms. It promotes interactive, peer-to-peer, real-time communication and visual learning, enabling group-based advisory communication. It was found that the ICT tools, such as YouTube and Interactive Voice Response (IVR), are used occasionally by the majority of the respondents. YouTube has significant potential to grow as a visual learning tool promoting video-based advisory support during the period of uncertainty, while Interactive Voice Response (IVR) can only be effective for specific types of advisories, which indicates moderate engagement due to poor content quality and ease of access. Lastly, it was observed that the majority of the respondents rarely use the radio and farm literature (Magazine/Folder/Leaflets, etc.) to receive advisory support during the period of crisis. Being a traditional medium, radio is losing its influence as a dominant source of advisory content, whereas reliance on the farm literature (Magazine/Folder/Leaflets, etc.) for advisory support material may not be

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effective during such uncertain times. Thus, it indicates that the utilization of mobile and digital communication tools among the respondents has increased significantly as compared to their traditional counterparts for receiving agricultural advisory support during the pandemic.

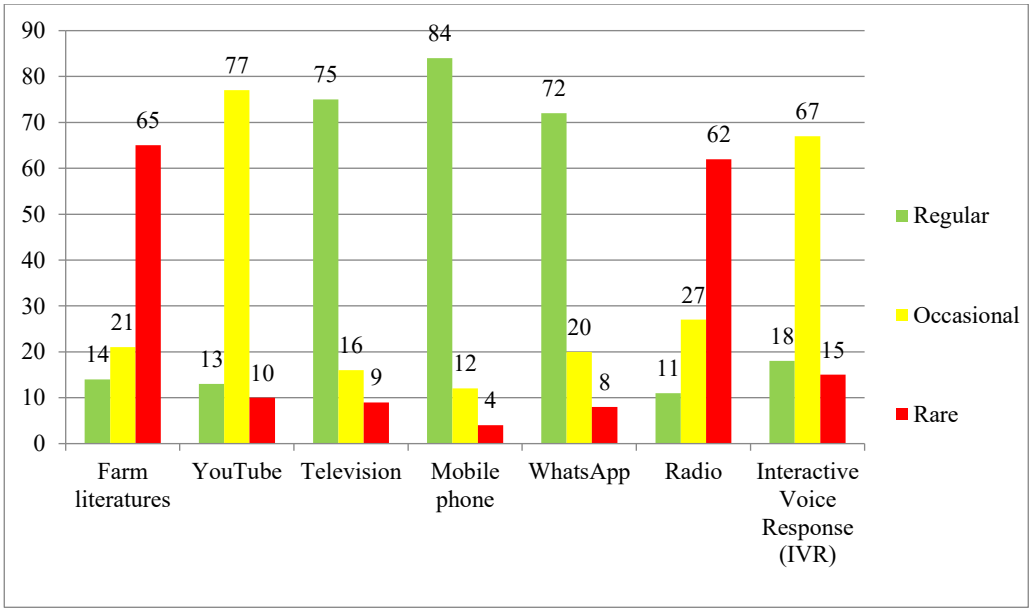

Figure 4: Distribution of the respondents based on the extent of utilization of ICT tools

Advisory on Vegetable Production

The findings uncover critical insights of the respondents on the basis of advisory support received on the production activities of vegetables during the pandemic. From figure 5, it is observed that the majority of the respondents received advisory support related to relief packages, government schemes, policies, and programmes, followed closely by credit facilities and crop insurance, which is considered their top advisory need at the time of crisis. Farmers were more concerned about financial security and policy support rather than agronomic technical guidance. The advisory support on price and availability of quality agricultural inputs is considered to be essential, where the disruptions in supply chains during the pandemic have caused uncertainty in the availability of seeds, fertilizers, and other inputs as a pressing concern. Information on weather forecasts helps farmers to plan agricultural activities efficiently. Advisory on plant protection and fertilizer management is essential for preventing loss of yield due to disease and pest attack, and maintaining crop health during times of crisis. Whereas, information on general crop management practices such as seed treatment and selection of planting materials, field preparation activities and soil testing, nursery management, sowing and transplanting of vegetable crops, and harvesting and post-harvest management were considered to be of lower priority, especially during the critical phase. Thus, the finding reveals a clear shift in farmers' advisory priorities during this period.

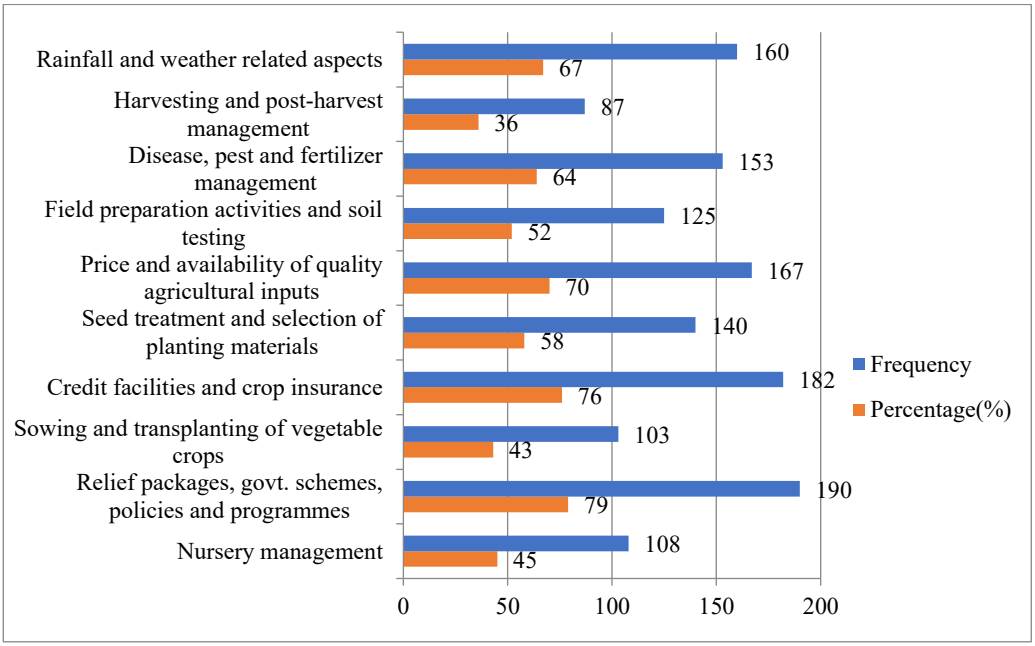

Figure 5: Distribution of the respondents based on advisory support received on the production activities of vegetables

Advisory on Marketing of Vegetables

The data sheds light on the key aspects of the respondents on the basis of advisory support received on the marketing activities of vegetables during the COVID-19 pandemic. From Figure 6, it is analysed that the majority of the respondents received advisory support related to price change and trends in the market as the most important advisory. Price volatility and reduced market transparency have created high market uncertainty, which is a major concern for farmers during times of crisis. Followed by information on market demand and supply for agricultural produce helps to understand vital market dynamics and prevent overproduction and losses. Market news is an essential aspect that helps farmers make informed decisions by obtaining timely updates of market information. Advisory on market intelligence helps in accessing strategic insights to look beyond the market, which is crucial during times of crisis. Information on transportation and logistics facilities is essential during the pandemic, as movement restrictions hinder the timely delivery of produce. Therefore, advice is essential for logistics planning and available transport solutions, especially for perishable crops like vegetables. While, least priority was given to the advisory support on post-harvest management and agricultural entrepreneurship, as farmers continue to focus primarily on short-term market needs rather than building long-term marketing aspects. Thus, the findings clearly show that farmers were mostly concerned with immediate and practical marketing advisories, especially those related to price trends, demand-supply dynamics, and focused on market access while minimizing loss and planning market engagement effectively even in times of crisis.

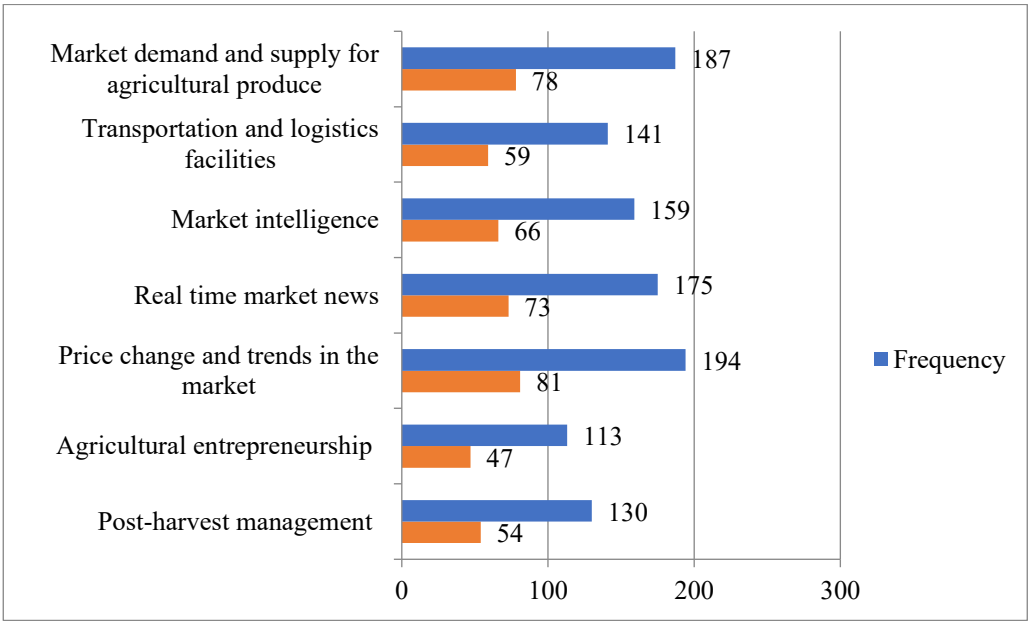

Figure 6: Distribution of the respondents based on advisory support received on the marketing activities of vegetables

Conclusion

The COVID-19 pandemic posed severe challenges to vegetable growers, adversely affecting the supply chains, labour availability, and market access. Given the disruptions in the supply chain of fresh farm produce due to COVID-19, further exacerbating the challenges faced in the agricultural sector, the threat to sustainable agricultural livelihoods and food security was imminent (Ozor, Acheampong and Nyambane, 2021). These challenges have underscored the critical importance of timely and effective agricultural advisory to support decision-making, ensuring crop health and maintaining livelihoods during the period of uncertainty. The findings of the study revealed that the majority of the respondents contact Input dealers and distributors and Progressive farmers/other farmers as the preliminary source of information for obtaining the agricultural advisory support. While it was concluded that the use of mobile phones and television (TV) is the most accessible ICT tool, where the majority of the respondents use them regularly for receiving the advisory support during the pandemic. It was found that the majority of the respondents received information on relief packages, government. schemes, policies, and programmes along with credit facilities and crop insurance as advisory support on the production activities of vegetables. Whereas, the information on price change and trends in the mark*et, al*ong with market demand and supply for agricultural produce, was the top advisory support received among the respondents on the marketing activities of vegetables during the COVID-19 pandemic. The study highlights the importance of agricultural advisory support, which played a vital role in helping farmers to navigate the unprecedented crisis. However, the COVID-19 protocols have restricted public gatherings and close contact activities, which have created challenges for agricultural advisory support to reach farmers through conventional ways. Thus, the pandemic has started a new era in agriculture and food ecosystem (Dash *et al.,* 2023), which emphasizes the urgent need for more resilient,

accessible, and technology-driven agricultural advisory that can effectively support farmers during such uncertain times. Strengthening these services through improved infrastructure, training, and integration of ICT tools will be essential for safeguarding livelihoods and ensuring food security during future disruptions. Building resilient agri-food systems through ICT tools can be a better solution to deal with the adverse effects of the pandemic (Zhan and Chen, 2021). However, during COVID-19, resilience was greatly leveraged on ICTs through enabling collaboration among partners, food production, and outsourcing (Meuwissen *et al.,* 2021). Addressing local and global food security issues, together with balancing the negative impact on the environment, requires the introduction of a new paradigm of agricultural production (Pecheniuk *et al.,* 2022). Digital solutions are playing an increasingly important role in transforming agricultural ecosystems and value chains, and strengthening food supply systems (Ayanlade and Radeny, 2020). Digital inclusion can increase productivity and resilience while reducing the vulnerability of smallholder farmers (Quayson, Bai and Osei, 2020). Therefore, these ICT-enabled technologies and their integration with the physical infrastructure were pivotal for enabling the (during-disaster) absorption and (post-disaster) recovery capacities (Sharifi, Khavarian-Garmsir and Kummitha, 2021). Digital technologies are increasingly recognized as essential tools for addressing global challenges related to sustainable development and employment in agriculture following the COVID-19 pandemic (Linde *et al.,* 2024). The future farming must be multifunctional and at the same time, ecologically, economically, and socially viable for sustainable livelihoods (Sanjay-Swami, 2021). Hence, the policymakers may allocate adequate budg*et al*ong with a proper roadmap for developing many such user-friendly ICT tools and applications to facilitate faster and real-time information to a larger number of farmers. Financial incentives for farmers' innovative activities should be a key part of government policy (Semchuk *et al.,* 2025). Moving forward, strengthening and expanding inclusive, timely, and technology-enabled advisory support is essential for building a more responsive and resilient agricultural sector for promoting sustainable livelihoods, withstanding future crises.

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Annexure-I

Interview Schedule

Role and Extent of Agricultural Advisory Support for Vegetable Growers amidst the COVID-19 Crisis

Date of interview: Sl. No.:

Name of the respondent…….....
District……..….
Block ……...…...
Gram panchayat……...….
Village …….....

Role and Extent of Agricultural Advisory Support

1) Have you received any agricultural advisory support during the period of Covid-19 pandemic? .....
2) The various sources of information from which you have received agricultural advisory support during the period of Covid-19 pandemic? Put tick mark against the appropriate response.

Sl. No.	*Sources of information*	*Strongly agree (SA)*	*Agree (A)*	*Disagree (DA)*
1.	Progressive farmers/other farmers			
2.	Neighbors/Friends/relatives			
3.	Agricultural officers (AAOs, AHOs etc.)			
4.	Input dealers and distributors			
5.	University/KVK scientists			
6.	Extension functionaries			
7.	Farmers group/NGO's/FPO's			
8.	Kisan Call Center			

3) What ICT tools are accessible for receiving agricultural advisory support during the period of Covid-19 pandemic? Put tick mark against the appropriate response.

Sl. No.	*ICT Tools*	*Strongly agree (SA)*	*Agree (A)*	*Disagree (DA)*
1.	Farm literatures (Magazine/Folder/Leaflets etc.)			
2.	YouTube			
3.	Television (TV)			
4.	Mobile phone			
5.	WhatsApp			
6.	Radio			
7.	Interactive Voice Response (IVR)			

4) How often do you use various ICT tools for receiving agricultural advisory support during the period of Covid-19 pandemic? Put tick mark against the appropriate response.

Sl. No.	*ICT Tools*	*Frequency of use*		
		Regular	*Occasional*	*Rare*
1.	Farm literatures (Magazine/Folder/Leaflets etc.)			
2.	YouTube			
3.	Television (TV)			
4.	Mobile phone			
5.	WhatsApp			
6.	Radio			
7.	Interactive Voice Response (IVR)			

5) What are the various types of agricultural information have you received on vegetable cultivation practices during the Covid-19 pandemic? …….

6) What are the various agricultural advisory supports have you received related to the production activities of vegetables during the Covid-19 pandemic?

Sl. No.	*Information category*	*Yes*	*No*
1.	Rainfall and weather-related aspects		
2.	Harvesting and post-harvest management		
3.	Disease, pest and fertilizer management		
4.	Field preparation activities and soil testing		
5.	Price and availability of quality agricultural inputs		
6.	Seed treatment and selection of planting materials		
7.	Credit facilities and crop insurance		
8.	Sowing and transplanting of vegetable crops		
9.	Relief packages, govt. schemes, policies and programmes		
10.	Nursery management		

7) What are the various agricultural advisory supports have you received related to the marketing activities of vegetables during the Covid-19 pandemic?

Sl. No.	*Information category*	*Yes*	*No*
1.	Market demand and supply for agricultural produce		
2.	Transportation and logistics facilities		
3.	Market intelligence		
4.	Real time market news		
5.	Price change and trends in the market		
6.	Agricultural entrepreneurship		
7.	Post-harvest management		

Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Author 1*	*Author 2*
Conceived and designed the research or analysis	Yes	No
Collected the data	Yes	No
Contributed to data analysis and interpretation	Yes	Yes
Wrote the article/paper	Yes	Yes
Critical revision of the article/paper	No	Yes
Editing of the article/paper	No	Yes
Supervision	No	Yes
Project Administration	Yes	No
Funding Acquisition	No	No
Overall Contribution Proportion (%)	50	50

Funding
No funding was available for the research conducted for and writing of this paper.

Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

Research involving animals (ARRIVE Checklist)
The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. The contexts of animals were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work.

Research on Indigenous Peoples and/or Traditional Knowledge
The author(s) solemnly declare(s) that this research has not involved Indigenous Peoples as participants or respondents. The contexts of Indigenous Peoples or Indigenous Knowledge were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or prior informed consent (PIC) of the respondents or Self-Declaration in this regard does not apply in cases of this study or written work.

Research involving Plants
The author(s) solemnly declare(s) that this research has not involved the plants for experiment and field studies. Some contexts of plants are also indirectly covered through literature review. Thus, during this research the author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

Research Involving Local Community Participants (Non-Indigenous) or Children
The author(s) solemnly declare(s) that this research has directly involved local community participants or respondents belonging to non-Indigenous peoples. The study this study has not involved any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people were only indirectly covered through literature review. Therefore, a prior informed consent (PIC) of the respondents or Self-Declaration in this regard is appended.

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)
The author(s) has/have NOT complied with PRISMA standards. It is not relevant in case of this study or written work.

Competing Interests/Conflict of Interest
Author(s) has/have no competing financial, professional, or personal interests from other parties or in publishing this manuscript. There is no conflict of interest with the publisher or the editorial team or the reviewers.

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During the preparation of this work, the authors have not used AI to assists the script translation and proof reading. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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To see original copy of these declarations signed by Corresponding/First Author (on behalf of other co-authors too), please download associated zip folder [Declarations] from the published Abstract page accessible through and linked with the DOI: https://doi.org/10.33002/nr2581.6853.080224.

INFORMATION AND CONSENT FORM FROM RESPONDENTS
(Non-Indigenous Respondents)
This form was translated into local language for the respondents

Title of the Research: Role and Extent of Agricultural Advisory Support for Vegetable Growers amidst the COVID-19 Crisis

Principal Researcher:	Soumya Sakti Dash Department of Agricultural Extension & Communication, Institute of Agricultural Sciences, Siksha 'O' Anusandhan (Deemed to be University) Bhubaneswar, Odisha, India.
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A) INFORMATION TO PARTICIPANTS

1. Objectives of the research
The objectives of this study were to evaluate the role and extent of agricultural advisory support to the vegetable growers during the COVID-19 pandemic.

2. Participation in research
The researcher will ask you several pertinent questions. This interview will be recorded in written form and should last about 50-60 minutes. The location and timing of the interview will be determined by you, depending on your availability and convenience.

3. Risks and disadvantages
There is no particular risk involved in this project. You may, however, refuse to answer any question at any time or even terminate the interview.

4. Advantanges and benefits
You will receive intangible benefits even if you refuse to answer some questions or decide to terminate the interview. You will also contribute towards the revitalization of agricultural advisory support for building a resilient agricultural sector promoting livelihood sustainability to withstand future crises.

5. Confidentiality
Personal information you give us will be kept confidential. No information identifying you in any way will be published. In addition, each participant in the research will be assigned a code and only the researcher will know your identity.

6. Right of withdrawal

Your participation in this project is entirely voluntary and you can at any time withdraw from the research on simple verbal notice and without having to justify your decision, without consequence to you. If you decide to opt out of the research, please contact the researcher at the telephone number or email listed below. At your request, all information concerning you can also be destroyed. However, after the outbreak of the publishing process, it is impossible to destroy the analyses and results on the data collected.

B) CONSENT

Declaration of the participant

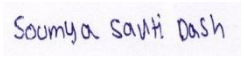
- ⇨ I understand that I can take some time to think before agreeing or not to participate in the research.
- ⇨ I can ask the research team questions and ask for satisfactory answers.
- ⇨ I understand that by participating in this research project, I do not relinquish any of my rights, including my right to terminate the interview at any time.
- ⇨ I have read this information and consent form and agree to participate in the research project.
- ⇨ I agree that the interviews be recorded in written form by the researcher: Yes ( ) No ( )

Signature of the participant : _____ Date : _____

Surname : _____ First name : _____

Researcher engagement

I explained to the participant the conditions for participation in the research project. I answered to the best of my knowledge the questions asked and I made sure of the participant's understanding. I, along with the research team, agree to abide by what was agreed to in this information and consent form.

Signature of the researcher :  Date : 27-08-2024

Surname: Dash First name: Soumya

- ⇨ Should you have any questions regarding this study, or to withdraw from the research, please contact Mr. Soumya Sakti Dash by e-mail soumyasaktidash2015@gmail.com
- ⇨ If you have any concerns about your rights or about the responsibilities of researchers concerning your participation in this project, you can contact the Aditya Prasad Kanungo, Department of Agricultural Extension & Communication, Institute of Agricultural Sciences, Siksha 'O' Anusandhan (Deemed to be University) Bhubaneswar, Odisha, India by email kanungoadityaprasad@gmail.com